ESA-114 Final Public Report

Introduction:
The Kellogg Battle Creek facility produces breakfast cereals that are distributed around the United States and uses steam to support its production operations. Facility personnel were interested in evaluating steam supply opportunities as well as considering options to reduce process steam demand. A summary of steam conditions and production details is not provided here due to confidentiality requirements.

Note: The sum of the cost savings for the individual projects listed above is *greater* than the cost savings if all of the listed projects are installed. The reason is that the separately listed projects do not account for the coincidence that occurs between projects. The sum of the individual fuel cost savings above is $500,000. The combined project energy cost savings is estimated at $423,000 per year using the 2005 average fuel cost of $7.50/MMBtu ($0.75/therm), and the water savings is estimated at $8,000 per year. The annual energy savings is 11.5-percent of the steam related natural gas and 7.5-percent of the total facility gas use.

Objective of ESA:
The primary objective of the ESA was to have the ESA lead, Mr. Roy Anderson, become comfortable with using the DOE steam tools to evaluate steam system related projects and to identify opportunities for steam system energy cost reduction. Particular attention was paid to the Steam System Assessment Tool (SSAT), which was used extensively to model projects.

Focus of Assessment:
The ESA targeted both the supply and demand side of the steam system, with the goal of limiting unnecessary steam loss in the boiler house and reducing process steam use. A total of six (4) different best practice options were evaluated during the ESA, with the others identified for further consideration. Brainstorming, walk-through assessments, review of boiler logs, combustion testing and the use of temperature metering equipment was used as appropriate.

Approach for ESA:
Roy Anderson and Tom Tucker discussed the facility operations prior to the visit to prepare for the ESA. During the ESA, key personnel from other Kellogg facilities participated to discuss general opportunities, anticipated outcomes of the ESA and areas to target. During discussions concerning the Battle Creek facility, the participants from the other facilities were encouraged to ask questions related to evaluation of opportunities, as well as application of the steam tools.

During the third day of the assessment, the Steam System Scoping Tool (SSST) was completed with input from Roy Anderson, with the Battle Creek facility scoring about 78%. Scores above 75% are considered very good, indicating that the Battle Creek facility is doing very well in general steam system management practices.

General Observations of Potential Opportunities:

- Near term opportunities would include actions that could be taken as improvements in operating practices, maintenance of equipment or relatively low cost actions or equipment purchases.
- Medium term opportunities would require purchase of additional equipment and/or changes in the system such as addition of recuperative air preheaters and use of energy to substitute current practices of steam use etc. It would be necessary to carryout further engineering and return on investment analysis.
- Long term opportunities would require testing of new technology and confirmation of performance of these technologies under the plant operating conditions with economic justification to meet the corporate investment criteria.

- Near Term opportunities: 5.8%
  Near/Medium Term opportunities: 3.0%

1. Reduce Low Pressure Steam Demand-Minimize Deaerator Vent Steam Loss (near term)
During the ESA, it was noted that the deaerator tank supplying feed water to the boiler is operated at a pressure of 35-psig. The high pressure is causing excessive venting of steam to the atmosphere. Discussions with the facility water treatment contractor indicate that there is opportunity to significantly reduce the steam loss. It is recommended that the deaerator tank be operated to meet water chemistry requirement for oxygen and carbon dioxide rather than simply using pressure and temperature as a guide. The estimated energy cost savings is $247,000 per year.

2. Change Boiler Blow Down Rate (near term)
The present blow down rate is approximately 10-percent based on readings from the boiler feed water and boiler water. The rate of blow down is controlled based on a conductivity set point through use of bottom and automatic blow down. It is recommended that the conductivity set point be increased to reduce the amount of waste generated, with input from the

boiler water treatment provider to be sure there are no special considerations that may limit the amount of change possible. The estimated energy cost savings is $82,000 per year.

3. Change Boiler Efficiency-Improve Exhaust Heat Recovery (near term/medium term)
There is an economizer installed on the boiler stack that is used to preheat boiler feed water. The economizer appears to be in good working order, but is not removing all of the heat normally available for recovery using non-condensing economizers. Temperature measurements indicate that the exhaust temperature leaving the economizer is approximately 330ºF, suggesting the potential for another 2-percent gain in boiler efficiency.

Due to the nature of other potential projects discussed for the boiler house, the options for recovering the additional heat are installing another economizer in series the existing one, or passing a greater volume of water or water at a lower temperature through the existing economizer. The estimated energy cost savings is $86,000 per year.

4. Install a Blow Down Heat Exchanger (near term/medium term)
The blow down is presently flashed for recovery of steam to the deaerator, with the remaining hot water sent to drain after being cooled to approximately 120ºF to 150ºF. The heat is removed using water supplied by a cooling tower. The alternative is use of an exchanger to preheat RO or another cool water source. Based on discussions, there is concern about keeping cool water flowing to prevent scaling on the exchanger. The options discussed were use of 3-way control valves or adjusting the automatic blow down rate to a continuous flow (the blow down rate can be adjusted to a "continuous" flow while still using the existing set point conductivity). This will allow heating and cooling to occur simultaneously, reducing the chance of scaling. The estimated energy cost savings is $85,000 per year.

Management Support and Comments:
The team was very supportive with both time and energy in working to obtain the information necessary to complete the ESA. Prior to the end of the ESA, Roy Anderson had already begun investigating the requirements for minimizing the vent loss from the deaerator tank. Staff from the other facilities were also involved initiating discussions pertaining to projects under investigation at their respective facilities. During the closeout meeting, Management was very supportive of the ESA activities and the results obtained.

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